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Delegating Tasks To a Virtual Assistant Based On Anticipated Battery Life

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Delegating Tasks To a Virtual Assistant Based On Anticipated Battery Life

ABSTRACT

When using a mobile device such as a smartphone, tablet, smartwatch, etc., users often encounter frustrating situations when the device runs out of battery charge. This disclosure describes techniques, implemented with user permission, to employ a virtual assistant to perform user-permitted tasks in case the device runs out of battery charge. The status of the remaining charge of the battery of a user's device is determined. If the device is likely to run out of battery charge prior to one or more upcoming tasks, the user is provided a user interface to selectively permit a virtual assistant application to perform one or more of the tasks on behalf of the user.

KEYWORDS

- Virtual assistant
- Digital personal assistant
- Battery charge
- Battery life
- Task calendar
- Task ranking
- Task delegation

BACKGROUND

When using a mobile device such as a smartphone, tablet, smartwatch, etc., users often encounter frustrating situations when the device runs out of battery charge. Such situations can occur at times when users do not have ready access to a means of charging the device, a backup battery, or an alternate device. In such situations, users are unable to perform important upcoming tasks because of the inability to use the device. While users can buy devices that can

operate for longer periods without needing to charge the battery, or a portable power bank, these impose additional costs and can only reduce the extent of the problem.

DESCRIPTION

Many mobile devices include a virtual assistant (digital personal assistant) or other equivalent application that can assist the user in a variety of ways, e.g., respond to user commands, perform one or more tasks as scheduled by the user, etc. With user permission, the user's upcoming tasks can be accessed and/or inferred by a digital personal assistant. Many of these tasks include one or more actions that can be performed by the virtual assistant on behalf of the user with the user's permission. For example, such tasks include: sending messages, responding to meeting requests, checking in for a flight, making a restaurant reservation, etc.

This disclosure describes techniques, implemented with user permission, for a virtual assistant to automatically perform user-permitted tasks in case the user's device runs out of battery. The status of the remaining charge of the battery of a user's device is obtained, e.g., by querying the device operating system. If the remaining charge indicates the device is likely to run out of power before the user is able to perform one or more upcoming tasks, the user is provided with options to selectively permit the virtual assistant to perform one or more tasks on behalf of the user. For instance, such tasks can include first and third party actions to be taken via various applications on the device.

To implement the described techniques, user permission is obtained for the virtual assistant to access the user's upcoming activities. For example, such activities can include attending a meeting, catching a flight, going to a concert, answering a phone call, etc. If the user permits, such activities can be identified based on content such as the user's calendar, email, text messages, etc. if permitted by the user.

If it is determined that the device is likely to run out of battery charge prior to an upcoming activity that requires user action, the virtual assistant can provide suggestions of actions that can be performed on the user's behalf if the user is unable to use their device. The following are some examples of suggestions for the user:

- "It looks like your phone will run out of battery charge before tonight's concert. If this happens, should I message Alice with your estimated time of arrival and ask her to bring a charger?"
- "Your phone battery will run out before you reach the airport. Should the airline be notified that you need a printed boarding pass?"
- "Your battery charge will not last until your evening tennis lesson with Jane. Should I send the teacher details and gym address to Jane so that she can look up directions?"

The user can choose to accept, modify, or decline the suggestions. Alternatively, the user can set up the virtual assistant to automatically perform the actions without needing explicit user confirmation.

The operation of the described techniques is based upon appropriate interfaces between the virtual assistant and the device operating system (OS) to enable the virtual assistant to receive information about battery charge levels. Such interfaces can be implemented in the form of an Application Programming Interface (API). Information regarding battery charge levels can include estimates regarding projected time of use available on currently remaining battery charge. Such estimates can be derived by applying suitable heuristics and/or employing an appropriately trained machine learning model, such as a simple neural network regression model.

Information about device battery charge projection is combined with upcoming user activities that are identified with user permission. The association between the actions to be

performed by a virtual assistant and various types of user activities can be based on a predefined list of actions, such as sending messages, rescheduling meetings, transferring data to the cloud, etc. The predefined actions list can be included with the virtual assistant and/or provided by the app infrastructure that describes user actions that can be performed with an application and/or the device OS. The upcoming activities can also include user actions that cannot be handled by the virtual assistant. Each task extracted from the upcoming user activities is classified based on whether it can be performed by the virtual assistant.

If the user permits, tasks in the list of upcoming tasks are ranked based on importance to the user and the current status of battery. With user permission, the ranking can be improved by using additional metadata such as recently used apps, actions performed within the apps and the OS, battery-relevant user decisions such as manually enabling a “battery saving” mode, etc. The task ranking and classification can be performed by any suitable machine learning model, e.g., a contextual bandits based approach. Such an approach is based upon taking into account the user context, normal battery usage, and user activities to generate the ranking.

The ranked list of tasks is presented to the user via a visual user interface (UI). The UI can be implemented via any UI mechanism that supports the use of the virtual assistant, e.g., suggestion cards, notifications/alerts, voice interaction, etc. The suggested actions can be organized by app category and presented using checkboxes or other input mechanisms that enable the user to provide selection input. The user can interact with the UI to indicate whether one or more of the suggested actions are to be performed by the virtual assistant, if the device does run out of battery charge. With user permission, the virtual assistant application on the user device can store information necessary to perform such tasks on a different device, e.g., a server, so that the tasks are reliably performed when the device runs out of battery.

The UI can provide indications of upcoming tasks that are determined important but that the virtual assistant lacks functionality. Such tasks can be marked as “unable to handle” and can serve as alerts for the user to take suitable action prior to the device running out of battery.

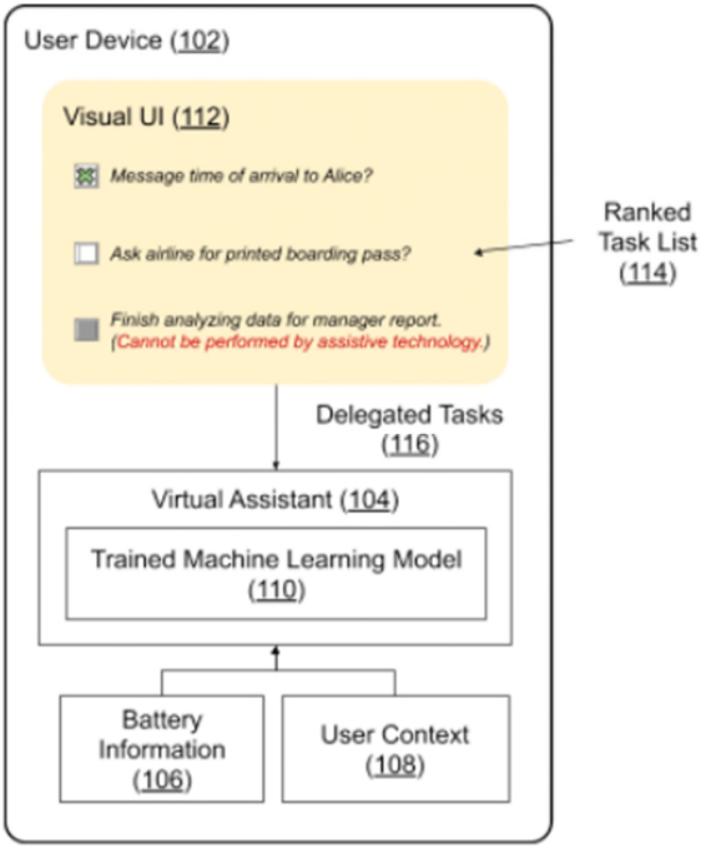

Fig. 1: Delegating tasks to a virtual assistant based on battery level

Fig. 1 shows an example implementation of the techniques described in this disclosure. With user permission, a virtual assistant (104) or device operating system on a user device (102) that includes a trained machine learning model (110) is provided with battery information (106), such as remaining charge and other metadata. If the user permits, the machine learning model can incorporate relevant information about the user’s context (108), such as the user’s upcoming activities.

The output of the model is a ranked list of upcoming tasks (114) ranked based on the likely importance of the task to the user. The ranked list is presented in a visual UI (112) that enables the user to indicate selections of whether an corresponding task is to be performed automatically by the virtual assistant in case the user device runs out of battery before the user can get to that task. The list also identifies tasks that cannot be delegated to the virtual assistant to serve as alerts to the user. Tasks that the user chooses to delegate (116) are performed by the virtual assistant on behalf of the user if the device battery is drained prior to the user performing the task. In Fig. 1, the user has chosen to let the virtual assistant handle messaging Alice in case the device battery loses charge. Tasks that are performed by the virtual assistant can be different from the user task itself, e.g., if the user has scheduled a meeting with another user Jane and the user device runs out of battery, the virtual assistant can send a message to Jane to inform Jane that the user is unable to join the meeting, and optionally, options to reschedule the meeting including an indication of a time that the user is likely to be available next, e.g., based on the user reaching a location where the device can be plugged in or based on other activities scheduled on the user's calendar.

A virtual assistant that implements the described techniques can improve the user experience (UX) of using battery-powered devices. The techniques can reduce user frustration and minimize task disruption due to the device running out of battery charge at inopportune times. The techniques can be implemented as part of a virtual assistant application, a device operating system, or in a combination.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may obtain or utilize user information (e.g., information about a user's upcoming activities, a user's

preferences, or a user's current location). In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

This disclosure describes techniques, implemented with user permission, to employ a virtual assistant to perform user-permitted tasks in case the device runs out of battery charge. The status of the remaining charge of the battery of a user's device is determined. If the device is likely to run out of battery charge prior to one or more upcoming tasks, the user is provided a user interface to selectively permit a virtual assistant application to perform one or more of the tasks on behalf of the user.